minute vessels were observed as between the uterus and decidua; but whether these were prolongations of the vessels proceeding from the lining membrane, or minute ramifications of the umbilical vessels, did not appear quite clear; for the rupture of the decidua by these vessels, during the separation, threw some little confusion upon the examination;—however the imperforate character of the decidua, which in some places we could observe, would, I think, lead to the inference that the minute vessels observed in separating the placenta from the decidua, were *not* prolongations of those noted between the uterus and this membrane, but extreme ramifications of the umbilical vessels adhering to the decidua. In two or three situations, a space of somewhat larger dimensions than the *superficies* of a half-crown piece was left, with the decidua attached to the lining membrane of the uterus, without the slightest laceration; beneath the decidua in this situation, a blow-pipe was introduced, and air was insufflated between it and the common lining membrane; the decidua was raised, and, to every appearance, there was not the slightest perforation. A director was then introduced, and the deciduous membrane divided; and, underneath, were observed two or three of those celebrated valvular orifices in the lining membrane of the uterus, most incontrovertibly closed by the apposition of the deciduous membrane. In another situation, after a portion of the decidua had been ascertained to be imperforate by the insufflation of air, it was separated a little more roughly; and upon attempting to pass a probe into the uterine sinuses, through one of their now well-known openings, a portion of decidua was found to have adhered to the margin of the orifice, and to close the aperture. On pushing the probe, however, through this portion of membrane, it readily entered one of the great uterine veins.—*Medical Gazette, September 6th*, 1834.

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## PHYSIOLOGY.

4. *Abstract of Observations on the Motions and Sounds of the Heart.* By Hugh Carlile, A. B. Demonstrater in the School of Anatomy in the University of Dublin.—The circumstances in the history of the heart's action which have been most the subject of controversy within late years may be enumerated as follow:—1st, the expansion and contraction of the auricles and ventricles, commonly called their "systole" and "diastole;" 2d, the beat of the heart against the side of the chest; 3d, the arterial pulse; and 4th, the sounds perceptible during the heart's motion. With a view to the explanation of these phenomena, the author has made some experiments on living animals, the results of which he was desirous of communicating to the Association.

In experiments of this kind it is desirable, as well for ensuring the means of accurate observation as for the sake of humanity, to diminish as much as possible the suffering of the animal. This can be accomplished by the use of the artificial respiratory apparatus, the animal having been suddenly deprived of sensation without shedding its blood. But the author has found that the application of this apparatus causes the heart to continue and terminate its motions in an unusual manner, and is therefore liable on some points to mislead the observer. In those cases in which the employment of artificial respiration is not expedient, there is much advantage in using very young animals for experiment. In this stage of life, as well as in animals of the inferior classes, the different organs appear to have a comparatively independent existence; and as their functions are in many instances performed with little disturbance under serious injury to the individual, they also retain their vitality long after their separation from the rest of the system. From the same causes very young animals appear to suffer less pain during experiment than those of mature age.

After discussing the methods of experimenting, the author proceeds to describe the opinions which have been held by other persons on the subjects in question, and to compare them with the conclusions to which his experiments have led.

1st. It has been asserted by Bichat, and his celebrity has induced many to adopt the opinion, that the ventricles possess a power of active dilatation, by means of which, when their systole has terminated, they are enabled to invite into their cavities the blood from the neighbouring auricles. The author, however, has ascertained by experiment, that there is no such dilating power in the ventricles, but that these muscles, when their state of contraction has ceased, become perfectly soft and flaccid, like all other muscles in their state of repose, and thus readily admit the blood from their respective auricles, which had become distended during the systole of the ventricles. The feeling of resistance which was mistaken by Bichat for a dilating power, and was supposed by him to accompany the diastole of the ventricles, the author has ascertained to be caused by the swelling of their muscular fibres during their systole.

The auricles contract but little upon their contents in man and in the higher classes of animals, the small quantity of blood which the ventricles discharge at each contraction being compensated by the frequency of their movement; while in the cold blooded animals, in which the heart acts with less frequency, the degree of expansion and contraction of both auricle and ventricle is much greater than in the former classes, and the quantity of blood sent through the heart at each movement is much larger.

2d. The impulse of the heart against the side of the chest, commonly called its beat, has been explained by different writers in various ways. Mr. Hunter supposed it to have been caused by the straightening of the curve of the aorta during the systole of the ventricles, whereby the apex of the heart was thrown forwards. Meckel refers it, in part, to the elongation of the arterial tubes during the ventricular contraction, and partly to the swollen state of the auricles at that time, by which the ventricles are pushed forward against the side of the chest. Harvey mentions an opinion held by some in his time, and which has been lately revived, namely, that the beat is caused, not by any active power in the ventricles, but by the muscular contraction of the auricles during their systole, by which the blood being sent with force into the ventricles, distends their cavities, and causes them to strike against the chest. This opinion, therefore, supposes the beat of the heart to coïncide with the ventricular diastole. Various other suppositions have been put forward upon this subject by different authors.

The author's experiments show that the beat of the heart is coïncident with the systole of the ventricles, and is caused by the peculiar shape which these parts acquire in their contracted and hardened state, their middle part becoming globular and prominent, and their apex being, as Hunter expressed it, "tilted" forward. During their systole the ventricles, like other muscles in a state of contraction, become swollen and hard to the touch, as was observed long since by Harvey. The greatest quantity of muscular fibre being situated about their middle part, where the "musculi papillares" are placed, this part during the systole assumes a globular and prominent form, projecting in front, and by its protuberance behind pushing forward the body of the ventricles. The apex is "*tilted*" forward for the following reason. The author has ascertained, by unravelling the structure of hearts prepared by boiling, that the fibres which pass from the base to the apex, on the front of the ventricles, are considerably longer than those similarly placed behind. In some human hearts he has found them in the ratio of five to three; the shape of the ventricles being nearly that of an oblique cone, whose base is applied to the auricles, and whose longest side is in front. Now, it is a law of muscular action, that fibres are shortened during their contraction in proportion to their length when relaxed. For instance, if a fibre one inch long, lose by contraction one-fourth of its length, or one quarter of an inch, a fibre two inches in length will lose *one* inch by a contraction of equal intensity. We have seen that the fibres, which, by their contraction cause the apex to approach the base of the ventricles, are much longer on the front than on the back part, and, consequently the former are more shortened during their contraction than the latter. The apex, then, does not approach the base in the line of the axis of the ventricles, but is drawn more to the side of the longer fibres, that is, towards the front, thus producing the "tilting" forward.

This conclusion is strengthened by the fact, that the forward motion of the apex of the ventricles is always proportioned to the obliquity of the form of these cavities in different classes of animals. In the heart of some reptiles, the frog for example, in which the lengths of the fibres of the ventricle before and behind are nearly equal, the tilting of the apex is scarcely discernible. The obliquity is greater, as far as the author has been able to observe, in the human heart than in that of any other animal.

Mr. Carlile has ascertained, also, that the ventricles assume this form during their contraction, after they have been separated from the auricles by a ligature, and even after they have been removed from the body, and placed in a vessel of tepid water, or held upon the hand, the auricles having been previously cut off; in all which cases the peculiar motions which accompany their contraction and relaxation were observed to recur as long as their power of moving remained; proving that the beat of the heart is produced altogether by the action of the ventricles during their systole, and that in these, as in all other muscles, the peculiar forms assumed during their contraction depend upon the relation, as to length and position, of the fibres of which they are composed.

3d. The arterial pulse, which is produced by the jet of blood sent from the left ventricle into the aorta during its systole, has been stated by Bichat and many others writers to be synchronous throughout the whole arterial system. But the experimenter can ascertain in his own person that the pulse is successive at different distances from the heart. If the hand be placed over the region of the heart, and the radial artery be felt at the same time, an interval will be distinctly perceptible between the beat and the pulse; and if the anterior tibial artery be substituted for the radial, the interval will be found still greater. Repeated observations of this kind show that the intervals of time between each beat of the heart and the corresponding pulse in different parts of the body are proportioned to the distances measured along the arteries, from the heart to the respective parts; and a knowledge of this fact leads, without further anatomical inquiry, to the conclusion that the beat of the heart is coïncident with the ventricular systole. For, as the intervals of time between the beat and pulse are proportioned to the distances from the heart to those parts where the pulses are felt, it follows that when the distances become evanescent the intervals of time will also vanish. Consequently, at the origin of the aorta the pulse will coïncide as to time with the beat of the heart; but the pulse at the origin of the aorta is necessarily synchronous with the ventricular systole, by which the blood is driven into that artery; and therefore the beat of the heart will coïncide with the ventricular systole, a conclusion which agrees with that drawn from positive experiment.

The proportion which exists in the pulse between the intervals and distances is dependent upon the elasticity of the arteries.

4th. An explanation of the *sounds* of the heart has become necessary since the employment of the stethoscope in ascertaining the state of internal parts. Laennec has well described these sounds, and properly refers the first to the rush of blood from the ventricles during their systole. But, in supposing that the second sound is produced by the auricular systole, he has fallen into an extraordinary error, as the second sound follows immediately after the first one, whereas the auricular systole precedes the ventricular. This mistake has been noticed by different writers since Laennec's time, who have rejected his explanation, and substituted others in its place.

From the observations which the author has made, he has no doubt that the second sound is caused by the obstacle which the semilunar valves present to the passage of the blood from the arteries back into the heart, at the termination of the ventricular systole.

At each contraction of the ventricles a quantity of blood is driven by them into the trunks of the arteries, which, being already full, accommodate the addition to their contents by a lateral expansion of their parts nearest to the heart. When the systole of the ventricles is at an end, the elastic force of the arteries, acting upon their contained blood, drives it towards the heart, its entrance into which is prevented by the sudden closing of the semilunar valves: and thus a shock is communicated to the front and upper part of the ventricles, and to the adjacent trunks of the arteries, which may be heard by the ear placed over the region of the heart. The relation, as to time, which the second sound has to the first, its abrupt character, and its coïncidence with the end of the ventricular systole, have led the author to adopt the foregoing opinion.

Mr. Carlile then described the experiments from which the greater number of the preceding conclusions have been drawn, and having detailed the circumstances of some made upon living subjects, proceeded to relate those which follow.

1. Artificial respiration having been established in a rabbit which had been strangled, and the heart having been exposed, the following observations were made.

The finger being applied successively to the front, back, and each side of the ventricles, conveyed the sensation of hardness and impulse when the ventricles assumed the globular form, and of softness and flaccidity when they became flattened and expanded. The end of a probe being laid on the front surface of the ventricles, was raised nearly a quarter of an inch during the former of these states, and sank, causing a slight depression on the surface, in the latter. The probe was more elevated when placed on the middle point of the surface, or on the front of the apex, than when placed elsewhere.

The right wing being held aside, so as to admit of the right auricle being seen, this was observed to swell during the continuance of the ventricles in their hardened state, and to diminish its size from the instant in which their flaccidity commenced, its degree of contraction being, however, inconsiderable. The contraction of the appendix was preceded by that of the rest of the auricle, and followed by the instantaneous movement and hardening of the ventricles. The contraction of the different parts of the auricle was successive, commencing at the venæ cavæ, and terminating at the appendix, of which last the contraction was much more sudden and distinguishable than that of any other part.

The heart in this subject continued to beat for an hour, when the motions in all its part ceased, and nearly at the same time; both auricles and both ventricles remaining distended, soft, and full of blood. The heart, separated from the body, was thrown into tepid water, where it remained, soft, and without motion, and had lost the power of contracting itself.

2. A rabbit having been strangled, the heart was exposed while still beating. In about ten minutes the left ventricle ceased to move, and had contracted itself firmly. In a minute or two afterwards all motion was at an end in the left auricle, which was also contracted. The right ventricle continued its movements for forty-five minutes, and during its contraction the apex of the heart was drawn a little to the right side. The right auricle continued to possess motion for an hour and three-quarters; and for the last twenty minutes its contraction proceeded slowly, and with a motion apparently vermicular, over its surface: always commencing at the part contiguous to the venæ cavæ, and ending at the appendix. The right auricle and ventricle contained each some blood when their motions ceased; but the heart having been thrown into tepid water, they gradually expelled their contents, assuming, as those of the left side had done, a firm and contracted state.

The difference of the states in which the hearts were found, after their motions had ceased, in the last two experiments, is remarkable, and appears to admit of the following explanation. In the last experiment, in which no means were employed to continue respiration, the left side of the heart soon ceased to move; because a continuance of the functions of the lungs, as proved by the experiments of Bichat, is necessary to the maintaining of its actions. The firmness of its contraction shows, that although its ordinary motions had ceased, it still retained a considerable share of organic life, as it is known that muscles, whose vitality is quite extinct, have no power of contraction. In the experiment in which respiration was artificially maintained, the left side of the heart continued to beat for an hour, the sustained function of the lungs affording to it a motive for prolonged action; but having been deprived of the influence which the central parts of the nervous system extend to organs in vital connexion with them, its powers of life were exhausted by the long continuance of its motions, and when these ceased, it was quite dead, and incapable of a vital contraction. The right side of the heart in the last experiment seems to have participated in the exhausted state of the left side, because its motions had been performed with much more energy during their continuance than would have been the case had not respiration been artificially maintained.—*Report of the Third Meeting of the British Association for the Advancement of Science.*

5. *Case of Superfœtation.*—A married woman, twenty-two years of age, was brought to bed of twins in the lying-in hospital of Berlin, on the 25th of January, 1832. The children were both girls, and died in two hours after their birth: their birth took place before the end of the seventh month from the date of pregnancy. One child was white, the other evidently a half caste, as was indicated by the shape of its head and the leaden tinge of its face, hands, and feet, which in colour resembled those who have been tinged by taking nitrate of silver in large doses. The same difference of colour was strikingly evident in the umbilical cords of the infants! but not in the membranes or placenta. On inquiry it appeared that she was in the habit of intimacy with a negro, shortly after or at the time she had conceived by her husband!—*Dublin Journal of Medical and Chemical Science.*

## PATHOLOGY.

6. *On the Pathology of Jaundice.* By William Stokes, M. D. &c.—Jaundice is to be regarded as a symptom rather than a disease *sui generis*, and it is a symptom which occurs in many diseases of a most essentially opposite pathological character. There is nothing, for instance, more different than disease accompanied by acute inflammatory action and disease without any inflammation at all; yet we may have perfect jaundice as a consequence of the one as well as the other. No diversity can be more complete than that which exists between the jaundice, arising from inflammation and organic lesion of the liver, and that which results from simple mechanical obstruction of the biliary ducts. It is, therefore, to be looked upon not as a disease, but as a symptom, and we may define it by saying, that it is a state in which the solids and fluids of the body are tinged more or less deeply with bile. Generally speaking, this presence of bile in fluids and solids, where it should not be normally, is accompanied by the absence of that secretion in the place where it is naturally found, the digestive tube. Yet it is an interesting physiological fact, and one of practical importance also, that we may have plenty of bile in the stools, during an attack of jaundice, or *that we may have jaundice coëxisting with even a copious flow of bile.* This is a strong proof in favour of the opinion, that some cases of jaundice have no connexion or dependence on the absorption of bile into the system, as, in the instances to which I have alluded, there is no mechanical retention of bile; the biliary ducts and gall-bladder are open, the bile passes freely into the intestines, and yet the whole body is jaundiced.